National Institute of Environmental Health Sciences

High temperature enhances host pathology in a snail-trematode system: Possible consequences of climate change for the emergence of disease

Author(s): Paull SH, Johnson PTJ
Year: 2011
Journal: Freshwater Biology. 56 (4): 767-778

Abstract:

1.Disease severity may be altered by the differential responses of hosts and parasites to rising temperatures leading to an increase or reduction in disease. The net effect of climate change on emerging diseases will reflect the effects of temperature on all life history stages of both hosts and parasites. 2.To explore how climate change differentially influences hosts and parasites, we studied the effect of increasing temperatures on different life stages of the multi-host trematode parasite Ribeiroia ondatrae, which has been linked to the emerging phenomenon of amphibian limb malformations, and its snail intermediate host Planorbella trivolvis. We determined the effects of temperature on the development of R. ondatrae eggs and redia larvae and the effects of parasite exposure (exposed and sham-exposed), temperature (13, 20, and 26 °C) and their interaction on snail host vital rates, including growth, mortality and reproduction. 3.Ribeiroia eggs developed four times faster at 26 °C than at 17 °C and did not develop at 12 °C. Higher temperatures increased snail growth, egg production and mortality. Infection interacted with temperature to enhance the growth of infected snails while reducing their fecundity at 26 °C. These results suggest that pathology associated with infection is amplified at higher temperatures. 4.The timing of interactions between R. ondatrae and P. trivolvis may be influenced by their physiological responses to temperature. Temperature-driven increases in the growth of infected snails coupled with the cessation of parasite development at lower temperatures suggest that warming temperatures will change host–parasite dynamics. Taken together, these results indicate that future climate change could alter parasite abundance and pathology by creating a ‘phenological mismatch’ between snail hosts and parasites, potentially leading to infection of both snail and amphibian hosts in earlier and, in the case of amphibians, more vulnerable stages of development.

Source: Ask your librarian to help locate this item.

Resource Description

Exposure :

weather or climate related pathway by which climate change affects health

Ecosystem Changes, Food/Water Quality, Temperature

Food/Water Quality: Other Water Quality Issue

Water Quality (other): Water temperature

Temperature: Fluctuations

Geographic Feature: ☑

resource focuses on specific type of geography

Freshwater

Geographic Location: ☑

resource focuses on specific location

Global or Unspecified

Health Impact: ☑

specification of health effect or disease related to climate change exposure

Infectious Disease

Infectious Disease: Foodborne/Waterborne Disease

Foodborne/Waterborne Disease: General Foodborne/Waterborne Disease

Resource Type: ☑

format or standard characteristic of resource

Research Article

Resilience: ☑

capacity of an individual, community, or institution to dynamically and effectively respond or adapt to shifting climate impact circumstances while continuing to function

A focus of content

Timescale: ☑

time period studied

Time Scale Unspecified